

Claims

1. A yarn feeding apparatus of a flat knitting machine that supplies a knitting yarn to knitting needles performing a knitting operation based on knitting data while moving a yarn feeding member in a width direction of a knitting fabric, comprising:

a knitting yarn sending mechanism that is provided on a supplying path of a knitting yarn and that sends out the knitting yarn to the yarn feeding member;

a buffer rod that is provided on a path on which a knitting yarn is supplied from the knitting yarn sending mechanism to the yarn feeding member, that can be displaced by swinging around a base end side, that pulls partially the knitting yarn out of the path when a front end side thereof is displaced to one side by swinging, and that returns the knitting yarn to the path when the front end side is displaced to the other side by swinging;

a spring that applies a force to the buffer rod in such a manner that the front end thereof is displaced to the one side by swinging so that the knitting yarn of a predetermined length is pulled out of the path with a predetermined tension of the yarn;

a sensor that detects a swinging displacement state of the buffer rod using as a reference an origin that is a position of the front end side when the knitting yarn is pulled out of

the path only for the predetermined length, and that derives a signal showing a detection result; and

control means for performing a pattern analysis based on knitting data, for calculating a theoretical value of a knitting stitch loop length to be knitted for each knitting needle, for controlling the knitting yarn sending mechanism in a necessary yarn sending mode in which the knitting yarn is sent out in synchronization with a movement of the yarn feeding member, and for correcting an element affecting a predetermined knitting stitch loop length before and after knitting one course of a knitting fabric in such a manner that an error between a length of a knitting yarn supplied for one course actually measured by the sensor based on an angle change in the swinging displacement of the buffer rod and a theoretical value of the knitting stitch loop length for one course is absorbed.

2. The yarn feeding apparatus of the flat knitting machine of claim 1, wherein as the element affecting the knitting stitch loop length, at least one of a stitch density as a preset value of a knitting cam for knitting stitches and a tension of the knitting yarn is corrected.

3. The yarn feeding apparatus of the flat knitting machine of claim 2, wherein the control means performs control in the necessary yarn sending mode in such a manner that as the knitting

stitch loop length calculated for each knitting needle, an average value of knitting stitch loop lengths of knitting needles belonging to a group including the knitting needle at a knitting stitch for knitting a same course of a knitting fabric is sent out from the knitting yarn sending mechanism.

4. The yarn feeding apparatus of the flat knitting machine of any one of claims 1 to 3, wherein the control means aligns the buffer rod, during control in the necessary yarn sending mode, based on a detection result by the sensor, by using a part of a knitting yarn sent during a knitting operation, in such a manner that the position of the front end side of the buffer rod stays in a predetermined vicinity of the origin position, before and after knitting one course of a knitting fabric.

5. The yarn feeding apparatus of the flat knitting machine of any one of claims 1 to 4, wherein when the sensor detects that a swinging displacement state of the buffer rod is beyond a predetermined limit during control in the necessary yarn sending mode, the control means stops the control in the necessary yarn sending mode, and controls the knitting yarn sending mechanism in a remedy mode in which the front end side of the buffer rod is returned to the origin position.

6. The yarn feeding apparatus of the flat knitting machine of any one of claims 1 to 5, wherein the controlling means controls the knitting yarn sending mechanism in a switchable mode between the necessary yarn sending mode and a mode with a constant tension in which based on a signal from the sensor, the front end side of the buffer rod is controlled to be kept in a vicinity of the origin position so that a tension of the knitting yarn is kept constant.

7. The yarn feeding apparatus of the flat knitting machine of claim 6, wherein the control means performs adjustment prior to a knitting operation of a knitting fabric in the mode with a constant tension in such a manner that a stitch density as the preset value of the knitting cam for knitting stitches is adjusted so that a predetermined loop length can be knitted.

8. The yarn feeding apparatus of the flat knitting machine of claim 1, wherein the control means calculates a length of a knitting yarn to be sent out according to the knitting data, separately for a zone in which the knitting yarn is sent out before starting a knitting operation at one end of a knitting fabric, a zone from the start of the knitting operation at the end of the knitting fabric to a start of deceleration of sending out the knitting yarn from the knitting yarn sending mechanism, a zone from the start of deceleration of sending out the knitting

yarn from the knitting yarn sending mechanism to a completion of knitting up to the other end of the knitting fabric, and a zone from the completion of the knitting operation of the knitting fabric to a stop the knitting yarn sending mechanism.